electrostat Chuck + Vheat transf

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L12: Entry 5 of 24 File: USPT Nov 20, 2001

DOCUMENT-IDENTIFIER: US 6320736 B1
TITLE: Chuck having pressurized zones of heat transfer gas

Brief Summary Text (3):
In semiconductor fabrication, a chuck is used to hold a substrate in a chamber for processing of a layer on the substrate. A vacuum chuck holds a substrate by evacuating gas from below the substrate through a vacuum port; a mechanical chuck has clamps that grip the peripheral edge of the substrate; and an electrostatic chuck holds a substrate by electrostatic attractive forces. While different types of chucks can be used to securely hold a substrate, electrostatic chucks are generally preferred because they press the substrate down more uniformly across a surface of an underlying support, thereby providing more uniform heat transfer rates across the back of the substrate; they allow use of a larger area of the substrate; and they are less prone to form contaminant particles that deposit on the substrate surface. A typical electrostatic chuck comprises an electrode covered by a dielectric, such as ceramic or polymer. When the electrode is electrically charged, electrostatic charges accumulate in the electrode and substrate, and the resultant electrostatic force holds the substrate on the chuck. Once a substrate is securely held on the chuck, process gas is introduced into the chamber and a plasma is formed to process the substrate.

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32 - Top
34 - bot

backside
plasma
clean

L8: Entry 15 of 17 File: USPT Oct 9, 1990

DOCUMENT-IDENTIFIER: US 4962049 A
TITLE: Process for the plasma treatment of the backside of a semiconductor wafer

Abstract Text (1):
A process is disclosed for the treatment of the backside or back surface of a semiconductor wafer such as a silicon wafer. By spacing the back side of a semiconductor wafer a predetermined distance from a cathode in a vacuum chamber and controlling the rf power and the pressure, a confined plasma may be used both to clean the back side of the wafer to remove impurities, including moisture and other occluded gases; as well as to deposit a layer of oxide on the back surface of the wafer to inhibit subsequent deposition of poorly adherent materials on the back side of the wafer which might otherwise flake off during processing of the front side of the wafer to form integrated circuits thereon.

Detailed Description Text (2):
The invention provides a process for the treatment of the backside or back surface of a semiconductor wafer such as a silicon wafer. A plasma may be used both to clean the back side of the wafer to remove impurities, including moisture and other occluded gases, as well as to deposit a layer of oxide on the back surface of the wafer to inhibit subsequent deposition of poorly adherent materials on the back side of the wafer which might otherwise flake off during processing of the front side of the wafer to form integrated circuits thereon.

Current US Cross Reference Classification (3):
438/906

CLAIMS:

18. A process for treating the back side of a semiconductor wafer which comprises:

(a) supporting a semiconductor wafer a spaced distance from an electrode with the back side of said wafer facing said electrode;

(b) flowing an inert gas through said chamber at a rate of from about 50 to about 200 sccm; and

(c) forming a plasma in the gap formed between said electrode and said back side of said wafer to remove undesirable materials from said back side of the semiconductor wafer.

19. A process for treating the back side of a semiconductor wafer which comprises:

(a) supporting a semiconductor wafer a distance of from about 0.25 to about 1 inch from an electrode with the back side of said wafer facing said electrode;

(b) flowing an inert gas through said chamber at a rate of from about 50 to about 200 sccm; and

(c) forming a plasma in the gap formed between said electrode and said back side of said wafer to remove undesirable materials from said back side of the semiconductor wafer.

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Plasma clean (dry)

L8: Entry 6 of 17 File: USPT Feb 26, 2002

back side

DOCUMENT-IDENTIFIER: US 6350689 B1
TITLE: Method to remove copper contamination by using downstream oxygen and chelating agent plasma

Brief Summary Text (13):
Another object of the present invention is to remove copper contamination from the backside of a wafer by dry cleaning to reduce the risk of cross-contamination.

Detailed Description Text (32):
It is noted that the method of the present invention may be used to clean either the back side 34 or the front side 32 of wafer 30. Depending upon the front side 32 of wafer 30, dry cleaning in accordance with the present invention may be applied on either or both sides 32, 34 of the wafer 30. If Cu metal lines are exposed, dry cleaning should apply only on the back side 34 of wafer 30. If Cu metal lines are protected by a dielectric but there are concerns of cross-contamination in subsequent processing steps, then the dry cleaning method of the present invention may apply to both sides 32, 34 of the wafer 30.

Detailed Description Text (34):
The process of the present invention is also admirably suited for copper rework. Copper rework is required when a wafer has been subjected to a copper deposition step that forms copper structures not within acceptable tolerances. In many instances, it is possible to remove the copper structures by wet etching or dry etching, and rework the wafer to redeposit copper. However, selectivity of wet-etching may not be so good and dry etching using a halogen requires a high processing temperature. In any event, such a reworked wafer must have the copper contamination removed from both the front side and back side of the reworked wafer.

Current US Cross Reference Classification (3):
438/906

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back side clean gas

L8: Entry 10 of 17 File: USPT May 9, 2000

DOCUMENT-IDENTIFIER: US 6059893 A
TITLE: Method for cleaning a semiconductor wafer

only (dry)

Brief Summary Text (10):
One aspect of the present invention is directed to a method of cleaning a semiconductor wafer by preparing a semiconductor wafer having a front side and a back side. The semiconductor wafer is rotated and an inert gas is blown against the back side of the semiconductor wafer to remove particles from the back side of the semiconductor wafer. The inert gas is blown against the back side of the semiconductor wafer so that a first flow is produced in a predetermined direction.

Brief Summary Text (11):
A further aspect of the present invention is directed to a method of cleaning a semiconductor device by preparing a semiconductor wafer having a front side and a back side. A first inert gas is supplied to the front side of the semiconductor wafer in a first direction, with the first inert gas being supplied thereto so that a first flow is produced in the first direction. The semiconductor wafer is rotated, and a second inert gas is blown against the back side of the semiconductor wafer to remove particles from the back side of the semiconductor wafer. The second inert gas is blown against the back side of the semiconductor wafer so that a second flow is produced in a second direction.

Brief Summary Text (12):
A further aspect of the present invention is directed to a method of cleaning a semiconductor device by preparing a semiconductor wafer having a front side and a back side. The semiconductor wafer is rotated, and an inert gas is blown against the back side of the semiconductor wafer to remove particles from the back side of the semiconductor wafer. The inert gas is blown against the back side of the semiconductor wafer so that a first flow is produced toward a periphery of the semiconductor wafer.

Brief Summary Text (13):
Yet another aspect of the present invention is directed to a method of cleaning a semiconductor device by preparing a semiconductor wafer having a front side and a back side. An inert gas is supplied to the front side of the semiconductor wafer in a predetermined direction. The inert gas is supplied thereto so that a first flow is produced in the predetermined direction. The semiconductor wafer is rotated, and the inert gas is blown against the back side of the semiconductor wafer to remove particles from the back side of the semiconductor wafer. The inert gas is blown against the back side of the semiconductor wafer so that a first flow is produced toward a periphery of the semiconductor wafer.

Detailed Description Text (9):
A method of eliminating particles, according to the present invention will now be described with reference to FIG. 3. A semiconductor wafer 1, which has been subjected to predetermined steps, is first introduced into the chamber of the present apparatus. Next, the semiconductor wafer 1 is placed on the vacuum chuck 2. At this time, the semiconductor wafer 1 is disposed so that a substantially central portion on the back side thereof is placed on the vacuum chuck 2. Next, the unillustrated motor is rotated and at the same time the manifolds 4 are supplied with the inert gases. Thus, the inert gases are discharged through the gas discharge nozzles 3 so that they are blown against the back side of the semiconductor wafer 1.

As a result, the particles, which have adhered to the back of the semiconductor wafer 1, are removed from the semiconductor wafer 1 under the action of forces of the inert gases.

Detailed Description Text (23):
Now consider that each of particles adheres to a predetermined position on the back side of the semiconductor wafer 11 as shown in FIG. 5. The particle is displaced as the gas discharge nozzles mount base 21 rotates. Since the flow of the inert gases on the back side of the semiconductor wafer 11 is now limited to one direction (corresponding to the direction extending from the center of the semiconductor wafer 11 to the periphery thereof) by the gas discharge nozzles 12, the directions of forces of the inert gases, which are exerted on each particle, are represented as indicated by arrows at all times. Thus, since the forces of the inert gases are applied toward the periphery of the semiconductor wafer 11, i.e., the exhaust trap 27, each removed particle always floats toward the exhaust trap 27 even if the particle is placed in any position. Since the exhaust trap 27 performs the exhaust action at all times, all the suspended particles are collected into the exhaust trap 27.

Current US Cross Reference Classification (5):
134/902

CLAIMS:

1. A method of cleaning a semiconductor wafer with an inert gas blown through a plurality of nozzles, comprising:

preparing a semiconductor wafer having a front side and a back side;

rotating the semiconductor wafer;

blowing the inert gas through the plurality of nozzles against the back side of the semiconductor wafer to remove particles from the back side of the semiconductor wafer, said inert gas being blown from the plurality of nozzles against the back side of the semiconductor wafer at a predetermined angle thereto and in only a single predetermined direction so that a first flow is produced across said wafer in said single predetermined direction; and

sucking the removed particles into an intake port of an exhausting means located adjacent to the semiconductor wafer, wherein a width of the intake port is wider than an outer diameter of the semiconductor wafer.

3. A method of cleaning a semiconductor device comprising:

preparing a semiconductor wafer having a front side and a back side;

supplying a first inert gas to the front side of the semiconductor wafer in a first direction, said first inert gas being supplied thereto so that a first flow is produced in the first direction;

rotating the semiconductor wafer;

blowing a second inert gas through a plurality of nozzles against the back side of the semiconductor wafer to remove particles from the back side of the semiconductor wafer, said second inert gas being blown from the plurality of nozzles against the back side of the semiconductor wafer at a predetermined angle thereto and in only a single second direction so that a second flow is produced across said wafer in said single second direction; and

sucking the particles removed by the second inert gas, into an intake port of an exhausting means located adjacent to the semiconductor wafer, wherein a width of the intake port is wider than an outer diameter of the semiconductor wafer.

5. A method of cleaning a semiconductor device with an insert gas blown through a plurality of nozzles, comprising:

preparing a semiconductor wafer having a front side and a back side;

rotating the semiconductor wafer;

blowing the inert gas through the plurality of nozzles against the back side of the semiconductor wafer in order to remove particles from the back side of the semiconductor wafer, said inert gas being blown against the back side of the semiconductor wafer from the plurality of nozzles at a predetermined angle thereto and in only a single predetermined direction so that a first flow is produced across said wafer in said single predetermined direction toward a periphery of the semiconductor wafer; and

sucking the particles removed by the inert gas, into an intake port of an exhausting means located adjacent to the periphery of the semiconductor wafer, wherein a width of the intake port is wide than an outer diameter of the semiconductor wafer.

7. A method of cleaning a semiconductor device comprising:

preparing a semiconductor wafer having a front side and a back side;

supplying an inert gas to the front side of the semiconductor wafer in a predetermined direction, said inert gas being supplied thereto so that a first flow is produced in the predetermined direction;

rotating the semiconductor wafer;

blowing the inert gas through a plurality of nozzles against the back side of the semiconductor wafer in order to remove particles from the back side of the semiconductor wafer, said inert gas being blown from the plurality of nozzles against the back side of the semiconductor wafer at a predetermined angle thereto and in only a single direction such that a second flow is produced across said wafer toward a periphery of the semiconductor wafer in said single direction; and

sucking the particles removed by the inert gas, into an intake port of an exhausting means located adjacent to the semiconductor wafer, wherein a width of the intake port is wider than an outer diameter of the semiconductor wafer.

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Semi-dry

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L8: Entry 1 of 17 File: USPT Jan 21, 2003

DOCUMENT-IDENTIFIER: US 6508258 B1
TITLE: Method and apparatus for cleaning flat workpieces within a semiconductor manufacturing system

Brief Summary Text (20):
One aspect of the present invention applies filtered, high purity steam to an active surface of a wafer to clean particles from the active surface. Preferably, a relatively cooler liquid is simultaneously applied to the back of the wafer to heat sink the large heat of vaporization and provide backside cleaning. Due to the elevated temperature produced by the condensing steam, the wafer can be dried quickly in situ. Because the invention does not use the "wet" batch (cassette) cleaning technology of the prior art, the clean wafer can exit from the system in a dry state, enabling a "dry in/dry out" single wafer processing strategy. Consequently, the cleaning apparatus of the present invention can be tightly integrated and form a part of a semiconductor processing system.

Detailed Description Text (34):
A source of deionized (DI) water 172 and a source of heated N.sub.2 purge gas 174 are coupled to inlet port 148 by valve 176 and tee 178. The DI water 172 is applied to the backside of the wafer 30 (not shown) to both wash the backside of the wafer and to carry heat away from the wafer, i.e. to provide a "heat sink." The heated N.sub.2 purge gas 174, coupled with nitrogen from tank 166 fed through heated components valve 156, line 162, and filter 158, is used to dry the wafer after cleaning. A drain is coupled to the valve assembly 178 by a drain valve 182. An additional (unheated) N.sub.2 purge 184 is coupled to the inlet 150.

Detailed Description Text (36):
After the main portion of the cleaning cycle has been completed, the ultrasonics are turned off and the back side water flow is stopped in an operation 214. The cleaner is then drained of the cleaning fluids that were accumulated during the back side rinsing of the wafer in an operation 216. In an operation 218, the top side steam is stopped, and a top side N2 purge is started. Subsequently, a backside N2 purge with heated N2 gas is commenced in an operation 220. After the wafer (or other workpiece) is dry, an operation 222 terminates the purges, stops the rotation of the wafer, opens the lid, and removes the clean, dry wafer from the cleaning system.

Current US Cross Reference Classification (4):
134/902

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electrost chuck
heat transfer
substr part +
cl 21

L13: Entry 11 of 12 File: USPT May 10, 1994

DOCUMENT-IDENTIFIER: US 5310453 A
TITLE: Plasma process method using an electrostatic chuck

Abstract Text (1):
Prior to plasma etching, a wafer is placed on conductive support pins which extend through an electrostatic chuck. The electrostatic chuck is disposed on a susceptor incorporating a cooling jacket. A potential for electrostatic attraction is applied to the electrostatic chuck. The support pins are lowered while they are grounded, thus placing the wafer on the electrostatic chuck. Subsequently, the support pins are retracted into the electrostatic chuck to release contact between the wafer and themselves. A heat medium gas is then supplied between the wafer and the electrostatic chuck to improve the heat transfer rate therebetween. A plasma is then generated in a process chamber, and the wafer is etched by using the plasma. Since the heat transfer rate between the wafer and the electrostatic chuck is improved before the generation of the plasma, damage to the wafer due to heat can be prevented, and the starting time required to start an etching process is shortened.

Detailed Description Text (19):
Subsequently, an etching gas is introduced into the process chamber 1 while the switch 72 of the RF power source 66 is closed, and the permanent magnet 38 is rotated to generate a plasma, thus starting an etching process. In this stage, the heat transfer between the wafer W and the electrostatic chuck 10 has been compensated by the heat transfer gas, and the temperature of the wafer W has already been adjusted by the cooling jacket 26. With this operation, an inadvertent rise in the temperature of the wafer W is prevented, and hence damage to the wafer W can be prevented. In addition, the starting time required to start an etching process can be shortened.

WEST Search History

DATE: Wednesday, January 29, 2003

Set Name side by side	**Query**	**Hit Count**	**Set Name** result set
	DB=USPT,PGPB,JPAB,EPAB,DWPI,TDBD; PLUR=YES; OP=ADJ		
L13	L12 same plasma	12	L13
L12	L11 same (chamber with etch$3 or deposit$3)	24	L12
L11	(wafer or semiconductor or substrate) with (chuck$3 or support$3 or piedestal or hold$3) with electrostatic with (heat$3 transfer$5)	207	L11
L10	(wafer or semiconductor or substrate) same ((chuck$3 or support$3 or piedestal or hold$3) with electrostatic with (heat$3 transfer$5))	222	L10
L9	L8 and ((chuck or support) with electrostatic with (heat$3 transfer$5))	0	L9
L8	L7 and l1	17	L8
L7	((134/902)!.CCLS. |(438/906)!.CCLS.)	2156	L7
L6	L5 and (heat$4 adj5 transfer$5)	0	L6
	DB=USPT; PLUR=YES; OP=ADJ		
L5	6251759.pn.	1	L5
	DB=USPT,PGPB,JPAB,EPAB,DWPI,TDBD; PLUR=YES; OP=ADJ		
L4	L3 and electrostatic	0	L4
	DB=USPT; PLUR=YES; OP=ADJ		
L3	6136725.pn.	1	L3
	DB=USPT,JPAB,EPAB,DWPI; PLUR=YES; OP=ADJ		
L2	(wafer or semiconductor or substrate) with ((back side) or backside or (second side)) with (clean$3 or remov$3) with (dry or plasma or gas$5)	281	L2
L1	((wafer or semiconductor or substrate) with ((back side) or backside or (second side))) same ((clean$3 or remov$3) with (dry or plasma or gas$5))	556	L1

END OF SEARCH HISTORY